

December 20, 2002

HSA-10/CC75A

Owen S. Denman, PE
President
Barrier Systems, Inc.
180 River Road
Rio Vista, CA 94571-1208

Dear Mr. Denman:

On October 4 you hand-carried two separate letters to Mr. Richard Powers of my staff. The first was addressed to Mr. Frederick G. Wright, former Director of the Office of Highway Safety Infrastructure, and requested acknowledgement of a high-speed crash test and our concurrence in the acceptability of the various TAU-II system configurations shown in your Design Manual. The second letter, addressed to Mr. Powers, provided information on TAU-II tests conducted on units anchored on an asphaltic concrete (AC) pad. The original certification test series for the TAU-II used a reinforced concrete pad.

Included with the first letter were copies of Safe Technologies, Inc. May 2002 report, "NCHRP Report 350 Crash Test Results – TAU-II Crash Cushion (70 mph Test)" and CD-ROMs and VHS tapes of the test that was run. That test was a modified NCHRP Report 350 test 3-31 with a 1991-kg pickup truck impacting a ten-bay (3 type A energy absorbing cartridges and 7 type B units) TAU-II head-on at 109.4 km/h. The total attenuator length was 8978 mm. All Report 350 evaluation criteria were met. The occupant impact velocity was reported to be 8.6 m/sec and the subsequent 10-millisecond ridedown acceleration was reported as 16.5 g's. Based on this and previous tests, I agree that the tested unit met Report 350 evaluation criteria for a test level 3 crash cushion for test 3-31 at a nominal speed of 70 mph and that the system configurations shown in Enclosure 1 may be considered crashworthy and used on the National Highway System with the following *caveats*:

- The systems fully tested to Report 350, and all those in between, may be considered to meet all pertinent evaluation criteria for the speeds listed. This includes the systems having 4, 5, 6, 7 or 8 bays and impact speeds of 70, 80, 85, 90 and 100 km/h, respectively.
- The tested 10-bay configuration meets Report 350 evaluation criteria for the head-on impact with the 2000P truck at a nominal speed of 110 km/h (70 mph)
- The 11- and 12-bay systems (and the 2- and 3-bay designs) may be assumed to have adequate energy-absorbing capacity to stop the pickup truck impacting head-on at the speeds shown for those configurations within the occupant risk limits recommended in NCHRP Report 350.

The second letter referenced Safe Technologies, Inc. April 2002 report entitled "TAU-II Crash Cushion (Asphaltic Concrete Foundation)" and included videotapes

of the crash tests. For installation on an asphalt pad, the standard front cable anchor was modified (extended rearward) and required additional anchor bolts, as was the rear stand-alone compact backstop. Based on the results of the tests you conducted, any of the anchoring designs shown on your foundation specifications sheet (Enclosure 2) may be considered acceptable for use with the TAU-II.

Sincerely yours,

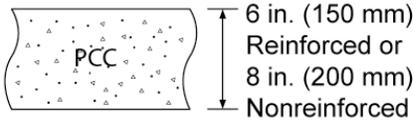
**Harry W. Taylor
Acting Director, Office of safety Design**

2 Enclosures

APPENDIX A: Foundation Specifications

The TAU-II Crash Cushion system has been designed to attach to concrete or asphalt foundations. Use the anchorage specified below depending on the foundation at the job site. Please see Appendix C for chemical anchoring specifications.

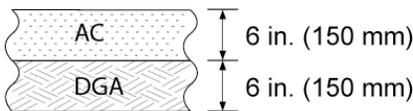
1. Concrete Pad



Foundation: Minimum 6 in. (150 mm) Reinforced PCC Pad or 8 in. (200 mm) Nonreinforced PCC Pad

Anchorage: 3/4 in. (20 mm) x 8 1/4 in. (210 mm) bolts
6 in. (150 mm) embedment

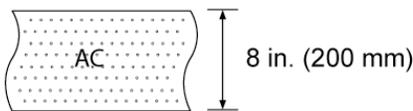
2. Asphalt over Subbase



Foundation: Minimum 6 in. (150 mm) AC over 6 in. (150 mm) Compacted DGA Subbase

Anchorage: 3/4 in. (20 mm) x 18 in. (460 mm) bolts
15 to 16 1/2 in. (380 to 420 mm) embedment

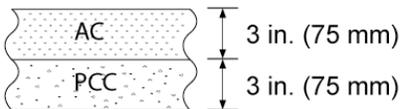
3. Asphalt Only



Foundation: Minimum 8 in. (200 mm) AC

Anchorage: 3/4 in. (20 mm) x 18 in. (460 mm) bolts
15 to 16 1/2 in. (380 to 420 mm) embedment

4. Asphalt over P.C. Concrete

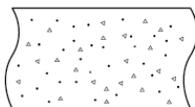


Foundation: Minimum 3 in. (75 mm) AC over minimum 3 in. (75 mm) PCC

Anchorage: 3/4 in. (20 mm) x 18 in. (460 mm) bolts
15 to 16 1/2 in. (380 to 420 mm) embedment

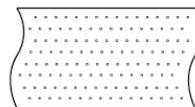
SPECIFICATION SUMMARY

Portland Cement Concrete (PCC)



Stone aggregate concrete mix, 4,000 psi (28 MPa) minimum compressive strength (sampling per ASTM C31-84 or ASTM C42-84a, testing per ASTM C39-84)

Asphalt Concrete (AC)



AR-4000 A.C. (per ASTM D3381 '83) .75" Maximum, medium (Type A or B) aggregate

Sieve Size	% Passing
1"	100
3/4"	95 - 100
3/8"	65 - 80
No. 4	49 - 54
No. 8	36 - 40
No. 30	18 - 21
No. 200	3 - 8

Compacted Subbase (DGA)



6 in. (150 mm) minimum depth, 95% compaction, class 2 aggregate

Sieve Size	% Passing
3"	100
2 1/2"	90 - 100
No. 4	40 - 90
No. 200	0 - 25

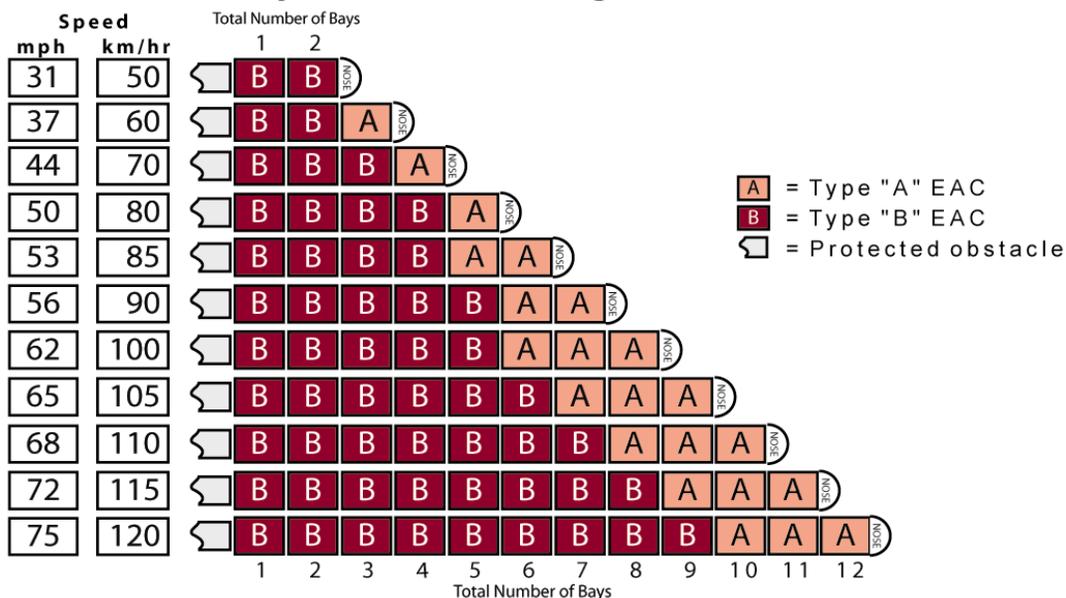
APPENDIX B System Configurations

The TAU-II™ Crash Cushion System has been fully designed and tested to comply with the evaluation requirements of the National Cooperative Highway Research Program Report 350 (NCHRP 350) for Test Levels 2 (70 km/h) and 3 (100 km/h). The Test Level 2 system contains four energy absorbing bays and the Test Level 3 system contains eight energy absorbing bays.

It is sometimes desirable to have a crash cushion that has an energy absorbing capacity that is less than Test Level 2, between Test Level 2 and Test Level 3 or greater than Test Level 3. Therefore, the following table indicates the number of bays, and the energy absorbing cartridge configuration, that would be required to absorb the kinetic energy of a 2000 kg (4400 lb.) vehicle impacting the front of the TAU-II system, head-on and at the velocity indicated.

Roadside safety features, such as crash cushions, must be installed in accordance with the AASHTO Roadside Design Guide, state and local standards and in conformance with the manufacturer's instructions. Instructions from the manufacturer are available by contacting Barrier Systems, Inc., Customer Service Department at 1-888-800-3691.

TAU-II™ System Configuration Chart



There are two types of Energy Absorbing Cartridges (EAC). Each EAC has a forward and rearward end. Type "B" EAC's have a solid cylinder wall with (3) vent holes on the rearward end. Type "A" EAC's have (8) 3" diameter holes around the circumference of the front half of the cylinder. When installing the EAC's in a system it is important to ensure that they are placed according to manufacturer specification and in the configurations illustrated above.